PADUCAH
Remediation Services
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761 Veterans Ave.
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February 15, 2008

ENM-L-0621

Mr. Reinhard Knerr, Paducah Site Lead
Portsmouth/Paducah Project Office
U.S. Department of Energy
P.O. Box 1410
Paducah, Kentucky 42002-1410

Dear Mr. Knerr:

DE-AC30-06EW05001 – REVISION OF *MONITORING WELL MAINTENANCE IMPLEMENTATION PLAN FOR THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY* (PRS/PROJ/0025)

Under cover of this letter, Paducah Remediation Services, LLC, (PRS) is providing the subject document for submittal to the Kentucky Division of Waste Management (KDWM). The document is a revision of the *Monitoring Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (BJC/PAD-327), which originally was approved by KDWM in June 2002.

I-02100-0668

The plan has been revised to (1) modify the activity schedule to avoid premature or unnecessary rehabilitation and (2) address concerns expressed by KDWM about the introduction of treatment acid into the aquifer, as specified in the original plan. Comments recently provided by U.S. Department of Energy (DOE) technical reviewers have been incorporated into the plan, as appropriate. A Comment Response Summary table also is included in this transmittal.

Because the previous version of this document (BJC/PAD-327) was approved by KDWM, PRS recommends that DOE seek approval of the revision. Suggested language for a transmittal letter to KDWM is enclosed.

If additional information is needed, please contact Tracey Duncan at (270) 441-5167.

Sincerely,

Russell Boyd

Russell Boyd, P.E., Site Manager
Paducah Remediation Services, LLC

REVIEWED FOR CLASSIFICATION
MB MAR 5 08
Initials Date
UNCLASSIFIED

In accordance with the requirements of Contract DE-AC30-06EW05001 and as acknowledged by the above signature, I hereby certify that the information provided in this transmittal has been prepared in accordance with all applicable requirements and the information is, to the best of my knowledge and belief, true, accurate, and complete.

RB:TLB:kje

Enclosures:

1. Monitoring Well Maintenance Implementation Plan
2. Comment Response Summary
3. Suggested transmittal letter

cc w/enclosures:
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Mr. Mike Guffey, PGDP Section Supervisor
Division of Waste Management
Kentucky Department for Environmental Protection
14 Reilly Road
Frankfort Office Park
Frankfort, Kentucky 40601

PPPO-02-XXX-XX

Mr. David G. Williams
U.S. Environmental Protection Agency
Region 4
DOE Remedial Section
Federal Facilities Branch
Waste Management Division
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr. Guffey and Mr. Williams:

REVISION OF *MONITORING WELL MAINTENANCE IMPLEMENTATION PLAN FOR THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY* (PRS/PROJ/0025)

Enclosed please find the revised version of the *Monitoring Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (BJC/PAD-327) for your review and approval. The previous version of this document was approved by the Kentucky Division of Waste Management (KDWM) in June 2002.

The Plan has been revised to (1) modify the activity schedule to avoid premature or unnecessary rehabilitation and (2) address concerns expressed by KDWM about the introduction of treatment acid into the aquifer, as specified in the original plan.

If additional information is needed, please contact David Dollins at (270) 441-6819.

Sincerely,

William E. Murphie
Manager
Portsmouth/Paducah Project Office

Enclosure

cc w/enclosure:
DOE Paducah Site Office, File Copy
Environmental Information Center

cc w/o enclosure:
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PRS/PROJ/0025

Monitoring Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

This document is approved for public release per review by:

N. Brenneman FEB 13 08
Paducah Classification and Control Office Date
Swift and Staley Team

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PRS/PROJ/0025

Monitoring Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—February 2008

Prepared for the
U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
PADUCAH REMEDIATION SERVICES, LLC
managing the
Environmental Management Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC30-06EW05001

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CONTENTS

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FIGURE

TABLES

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ACRONYMS

AKGWA	Assembled Kentucky Groundwater Database
BART™	Biological Activity Reaction Test
Ca	calcium
Eh	oxidation reduction potential (or Redox Potential)
EMP	Environmental Monitoring Plan
Fe	iron
KAR	*Kentucky Administrative Regulations*
MIC	microbial induced corrosion
Mn	manganese
MW	monitoring well
PGDP	Paducah Gaseous Diffusion Plant
PZ	piezometer
pH	hydrogen-ion concentration
S	sulfur/sulfate
SRB	sulfate-reducing bacteria

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EXECUTIVE SUMMARY

The purpose of this monitoring well (MW) maintenance implementation plan is to protect and maintain the integrity of the MW network at the Paducah Gaseous Diffusion Plant (PGDP) in order to obtain representative groundwater samples. This plan applies to the 317 wells (278 MWs and 39 piezometers) that have a current status in the environmental monitoring program. Previous down-hole investigations at PGDP (BJC 2000a; BJC 2000b; BJC 2001) indicated that common MW maintenance problems include biofouling and corrosion. This resulted in the implementation of the MW maintenance program and subsequent rehabilitation of 111 MWs. This inspection and maintenance plan combines regular assessment of each well's physical condition, geochemical trends, and performance history to identify physical or chemical related problems with the well. This maintenance implementation plan outlines MW evaluation methods including visual inspections (including down-hole equipment examination), evaluation of physicochemical data, well performance assessments, and down-hole video inspections if warranted.

A variety of mechanical and chemical MW rehabilitation techniques can be used on the MWs depending on the severity of the problem. Methods include brushing; redevelopment by surging and/or pumping; and in MWs with severe biofouling, chemical treatment. Compliance-driven MWs should be given priority for maintenance when problems are identified.

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1. INTRODUCTION

1.1 PURPOSE

Groundwater monitoring wells (MWs) often degrade in quality with age. Effective stewardship, a program of routine inspections of the physical condition of each MW, and a review of the well's performance and geochemical trends ensure that representative water-quality monitoring and hydrologic data are being obtained from the MW network at the Paducah Gaseous Diffusion Plant (PGDP). This plan is a revision to the *Monitoring Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (BJC 2005). The purpose of this maintenance implementation plan is to protect and maintain the integrity of the MW network by implementing a systematic approach through the following:

- Inspecting the physical condition of MWs;
- Reviewing performance and geochemical trending data;
- Identifying maintenance needs that, if implemented, can extend the life of the MW; and
- Identifying MWs that require rehabilitation.

The *Environmental Monitoring Plan Fiscal Year 2007, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (EMP) (PRS 2006) provides a list of all site MWs, including their status and monitoring frequency. This maintenance plan, in conjunction with the EMP, allows the groundwater program to focus available resources on MWs that provide the most useful data.

1.2 STRATEGY

Wells are best maintained by a preventative maintenance program involving routine inspection and monitoring of the well's performance along with preventative maintenance and treatment, as necessary. The objective of this plan is to develop an inspection and maintenance monitoring approach that identifies and treats MWs with problems. Compliance-driven MWs with identified problems should be prioritized for maintenance and/or rehabilitation ahead of other MWs. The schedule for maintenance also will consider current and projected budgets and be consistent with the baseline.

The maintenance schedule will be determined annually based on a review of and consideration of each well's sampling status, the physicochemical parameters (physical and/or chemical groundwater properties) indicative of biofouling or encrustation, physical integrity, and visual examinations (as recorded in field log books during sampling).

1.3 BACKGROUND

As of January 2008, there have been 429 MWs and piezometers (PZs) installed or drilled at the PGDP. These wells and PZs were installed in conjunction with various groundwater quality monitoring programs, remedial investigations, plume characterization, and aquifer testing projects. Of these, 112 have been plugged and abandoned in accordance with Kentucky Administrative Regulations (*KAR*) 401 *KAR* 6:310. The remaining 317 MWs and PZs have been assigned a current status designation according to the EMP and are included in this inspection and maintenance program. Based on the Fiscal Year 2008 EMP, which is revised annually, the 317 wells are comprised of 278 MWs and 39 PZs.

A regular program of MW maintenance began in 2002 (BJC 2002). This program was initiated following three down-hole video investigations at PGDP (BJC 2000a; BJC 2000b; BJC 2001), which revealed evidence of corrosion (minor to severe) in stainless steel casings and biofouling in the screens of 75 compliance MWs. The results of these corrosion studies at PGDP (BJC 2000a; Underwood 2000a; Underwood 2000b) indicate that corrosion in MWs at PGDP is primarily caused by electrochemical phenomena (galvanic electrolysis) and enhanced by microbial induced corrosion (MIC), in this case, sulfate-reducing bacteria (SRB). The galvanic activity is localized between the stainless steel well casing (anode) and the iron isolation casing (cathode). To a lesser degree, SRB also are attacking the well casing exterior below the isolation casing, usually along the weaker stainless steel weld seams. The use of polyvinyl chloride well casing in new wells, unless in a known volatile organic compound source area, will prevent future corrosion problems. Since initiation of the MW maintenance program, 111 MWs have been rehabilitated.

2. MAINTENANCE MONITORING

Maintenance monitoring involves the collection and evaluation of physical, hydraulic, and water quality factors for the purpose of detecting deteriorating conditions in the well. Maintenance monitoring helps identify problems early so that preventative maintenance can be scheduled. The maintenance monitoring program involves visual inspection of MW components, including down-hole equipment; evaluating physicochemical water quality data; microbial sampling and analysis, if warranted; assessing well performance indicators; and down-hole video inspections as needed. MWs that are sampled for water quality and contaminant characterization will be inspected on an annual basis. MWs and PZs that are used for water-level measurements only will be inspected every three years (triennial basis) (Figure 1). All MWs with a current status designation in the EMP will have well depth measurements performed on a triennial basis. Maintenance monitoring activities planned are summarized herein.

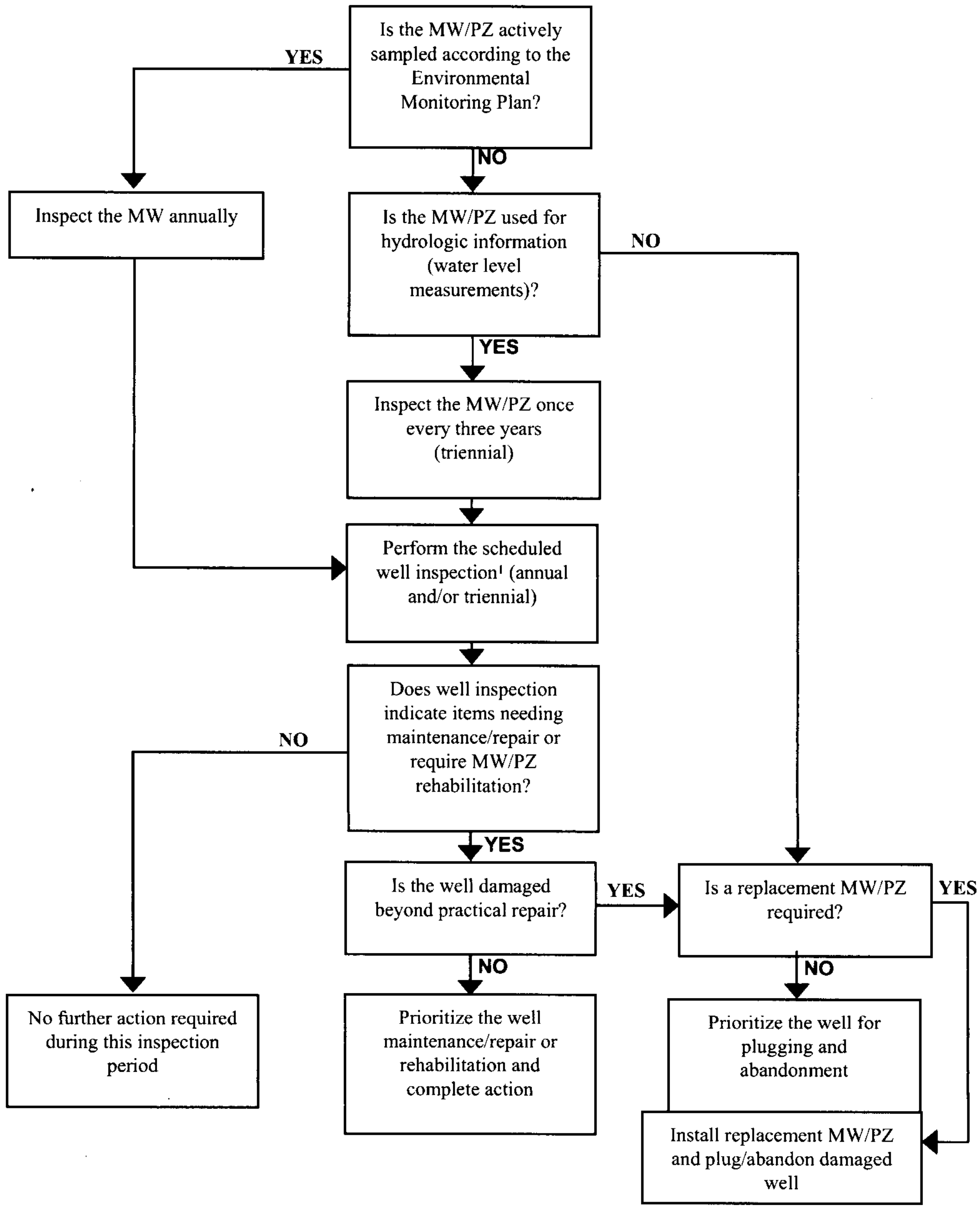
2.1 VISUAL INSPECTIONS

During routine sampling events, sampling personnel should inspect the MW and note any deficiencies in the field log book. For MWs that are sampled for water quality and contaminant characterization, a checklist (Appendix) should be completed on an annual basis in addition to the routine field log book entries. When pumps and discharge lines are removed (such as for routine maintenance and repair), they will be inspected for signs of corrosion, biofouling, and encrustation. Equipment showing evidence of this will be photographed and observations noted in field log books. All equipment will be refurbished and rebuilt if necessary. Items to be inspected during routine sampling events include the following:

- MW identification labeling [in addition, the Assembled Kentucky Groundwater Database (AKGWA) label should be present];
- Condition of casing, well covering, protective posts, and concrete pad;
- Well security; and
- Well access including condition of gravel pad, entrance road, and drainage culverts.

During triennial inspections, the total depth of the well should be measured. Depth measurements are the only direct method of measuring any change in the down-hole physical condition of a well by comparing these measurements to a reference depth. Significant differences (>20% of the screened or open interval) between the measured depth and the reference depth may indicate the following:

- Accumulations of sediments or other debris (encrustation by-products) in the bottom of the well;
- Obstructions in the well possibly caused by structural failure of the well casing or screen; or
- Field measurement errors (e.g., wrong well, recording errors, or incorrect measurement reference point used) or errors in the weighted tape used to measure the depth.



[1] Includes visual inspection, evaluation of physiochemical water quality data (parameters specified in Section 2.2), assessment of well performance, and down-hole video inspection (as needed).

Figure 1. PGDP Monitoring Well Maintenance Program

Many wells accumulate sediment at the bottom, which may plug the screened or open interval if the well has not been properly developed. This sediment can affect the performance of the well and the quality of chemical analyses. When field personnel make the total depth measurement, they should indicate if the depth measurement was hard or soft. A measurement is considered soft when it's difficult to detect whether the indicator probe/measuring tape has touched the bottom of the well (this is often an indicator of possible sediment or bacterial slime buildup at the bottom of the well and often is noted by presence of mud on the weighted tape).

2.2 PHYSICOCHEMICAL WATER QUALITY

The purpose of physicochemical monitoring is to detect changes in parameters that may reflect well deterioration or indicate the cause of well deterioration. Table 1 is a summary of physicochemical parameters relevant in well maintenance (Smith 1995; ASTM 2005). Not all of the parameters herein are analyzed for in every well sampled at PGDP, but the hydrogen-ion concentration (pH), specific conductance, and turbidity are field parameters that are collected with every sampling event. The remaining parameters [redox potential (Eh), total organic carbon, iron (Fe), manganese (Mn), and sulfur/sulfate (S)] can be used for physicochemical monitoring in wells where the data are collected or obtained by a special sampling event if deterioration of the well is expected. Rather than provide specific criteria or trigger levels for these parameters, the objective is to detect changes or abrupt fluctuations over time (evaluate time-series charts) and early enough to make maintenance decisions. Fluctuations in physicochemical parameters, such as increases or decreases in Eh, pH, conductivity, Fe, Mn, and S concentrations, are indicative of the well environment (Smith 1995). Redox potential is very important to the make-up of the microflora in the well and aquifer and also to the fate of Fe, Mn, and S, which produce mineral forms of precipitates. Parameters relevant to formation of encrustations [e.g., calcium $(Ca)^{2+}$ ion] will be evaluated where data is available. Total organic carbon content will be evaluated because it is an empirical indicator of biofouling potential. Particle counting and turbidity are significant site-specific parameters denoting the origin of minerals and/or precipitates. Increases in turbidity and particle counts indicate suspended solids content that may result from silting or biofouling (Smith 1995). Such solids data are useful in specifying remedial treatments (e.g., if only silt is present, the well may simply require bailing and/or redevelopment).

Performing an annual review on surveillance MWs analytical data relative to key physicochemical changes is necessary in the overall preventive maintenance program. Analytical data assessment reports currently are being reviewed on all landfill compliance wells under various schedules. The assessment reviews also should evaluate any noticeable changes relating to biofouling monitoring. Historical data are indispensable in a preventive maintenance program. Time series plots revealing parameter changes in analytical data (Table 1), along with visual examinations of sample characteristics (e.g., bacterial slime, etc.), are useful in analyzing current or potential bore hole conditions. Prioritizing MWs for maintenance is subjective; however, a review of the historical data should reveal severe problems. The historical data, when combined with physicochemical monitoring, is the best approach to maintenance prioritization.

If physiochemical data give a strong indication of potential biofouling, a test for microbial populations is recommended. Currently, the most practical approach to detect nonfilamentous, metabolically active biofouling microflora in water wells is the Biological Activity Reaction Test (BART™) method. The BART™ test kits are inexpensive, are relatively easy to use, and are increasingly accepted as the standard biofouling monitoring method in the water well industry.

Table 1. Summary of Physicochemical Parameters Relevant to Well Maintenance

Parameter	Diagnosis
Eh (redox potential)	Indicator of probable metallic ion states and microbial activity. Usually bulk Eh, which is a composite of microenvironments.
pH	Indicator of acidity/basicity and likelihood of corrosion and/or mineral encrustation. Combined with Eh to determine likely metallic mineral states present, and with conductivity and alkalinity to assess inorganic salts occurrence.
Specific Conductance	Indicator of total dissolved solids content and a component of corrosivity assessment. Changes also are caused by microbial activity.
Turbidity / Total Suspended Solids	Indicator of suspended particles content, suitable for assessment of relative changes indicating changes in particle pumping or biofouling.
Total Organic Carbon	Empirical indicator of the potential for biofouling.
Fe (total, Fe^{2+}/Fe^{3+}, minerals, and complexes)	Indicator of clogging potential, presence of biofouling, Eh shifts.
Mn (total, Mn^{2+}/Mn^{4+}, Mn minerals and complexes)	Indicator of clogging potential, presence of biofouling, Eh shifts.
S (total, $S^{2-}/S^0/SO_4$, S minerals and complexes)	Indicator of clogging potential, presence of biofouling, Eh shifts.

Source: Smith 1995

2.3 WELL PERFORMANCE

During routine well sampling activities, factors relating to well performance are logged in field notebooks. These factors will be evaluated along with other information to determine the need for maintenance. Table 2 summarizes a variety of well performance problems and causes.

2.4 DOWN-HOLE VIDEO INSPECTION

Inspection with a down-hole video camera is not a routine part of maintenance monitoring, but may be conducted if severe down-hole problems are detected. A down-hole video survey provides a direct view of conditions within wells. The video can be used to document the occurrence of well damage and deterioration over time. A progression of videos in any particular well, if available, provides a direct way to watch changing conditions in the well (e.g., progressing screen corrosion or biofouling development).

Table 2. Causes of Poor Well Performance

Performance problems	Possible cause
Sand/Silt Pumping	Inadequate screen and filter-pack selection or installation, incomplete development, screen corrosion or parting, collapse of filter pack due to excessive vertical velocity and washout. Rock wells: presence of sand or silt in fractures intercepted by well-completed in open hole, incomplete casing bottom seat. Causes pump and equipment wear and plugging.
Silt/Clay Infiltration	Generally inadequate seal around the well casing or casing bottom, infiltration through filter pack, or "mud seams" in rock, inadequate development, or overdevelopment in tills. Or material so fine that formation cannot be monitored without accepting some turbidity. Causes reduced performance, filter plugging, and interference with samples.
Pumping Water Level Decline	Outside influences such as area or regional water level declines or well interference or plugging or encrustation of the bore hole, screen, or gravel pack. Sometimes a regional decline will be exaggerated at a well due to plugging.
Lower (or Insufficient) Yield	Dewatering or caving in of a major fracture or other water-bearing zone, pump wear or malfunction, encrustation, plugging, or corrosion and perforation of column pipe, increased total dynamic head in water delivery or treatment system.
Complete Loss of Production	Most typically pump failure (mechanical or electrical), but also possibly catastrophic loss of well production due to dewatering, plugging, and collapse.
Chemical Encrustation	Deposition of saturated dissolved solids, usually high Ca, magnesium (Mg), carbonate and SO_4 salts or iron oxides. Causes reduced specific capacity and well efficiency, interference with sample analyses. Actually rare except for deep wells in highly mineralized groundwater, as in the western U.S.
Biofouling Plugging	Microbial oxidation and precipitation of Fe, Mn, and S with associated growth and slime production. Often associated with simultaneous chemical encrustation and corrosion. Associated problem: well "filter effect": samples and pumped water are not necessarily representative of the aquifer. Usually includes "iron bacteria." Causes reduced specific capacity and efficiency, reduced yield, interference with sample quality, and even complete well production loss. Often works simultaneously with other problems such as silting.
Pump/Well Corrosion	Natural aggressive water quality, including hydrogen sulfide, sodium chloride-type waters, biofouling, and electrolysis due to stray currents. Aggravated by poor material selection in pump or column pipe, casing, and screen. May result in secondary system symptoms.
Well Structural Failure	Tectonic ground shifting, ground subsidence, failure of unsupported casing in caves or due to poor grout support, casing or screen corrosion and collapse, casing insufficient for in-ground conditions, local site operations, collapse of unstable rock bore hole.

Source: Smith 1995

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3. MECHANICAL AND CHEMICAL TREATMENT

Lack of a maintenance program can lead to MW performance deficiencies (physical problems) or sample quality degradation (chemical problems). These problems are inherent to MWs since they often are left idle for long periods of time between sampling events. Typical solutions for these problems that would be applied to water supply wells may not be appropriate for MWs because of the need to minimize their impact on the conditions that the wells were installed to evaluate. In other words, methods of well rehabilitation should not, more than transiently, change the chemistry of the groundwater being monitored (ASTM 2005).

Methods to rehabilitate a MW may include redevelopment to remove fine-grained materials and other materials that may be clogging the well screen. Redevelopment can be accomplished using surge blocks, pumping, water jetting, or a combination of methods. In severe cases, chemical rehabilitation may be used for redevelopment for biofouling. A summary of rehabilitation methods is listed in Table 3.

Table 3. MW Rehabilitation Methods

Method	Description
Brushing	A hard bristle brush is used in an up and down motion on the well screen.
Bailing	Solids are bailed from the bottom of the well using a suction bailer.
Pumping	A small-diameter pump is used to overpump the well to remove solids; can also be used with surging over 1-2 foot intervals of the screened zone.
Jetting	A jetting tool is used to clean the screen interval with a high-velocity stream of water.
Biofouling Chemical Treatment	A bioacid dispersant and acid treatment is introduced into the well screen and agitated to remove biological induced accumulations.

3.1 PUMP REMOVAL

The first step for MW rehabilitation involves removing the pump and associated discharge line (tubing) and inspecting for evidence of mechanical failure, biofouling, encrustation, or corrosion. Equipment showing evidence of these will be photographed. All pumps will be refurbished and rebuilt, if necessary, before reinstalling.

3.2 MECHANICAL REDEVELOPMENT

Following removal of the pump and pump column, it is best to brush the MW to remove any biofilm, scale, or encrustation. Brushing simply involves running a hard bristle brush up and down the length of the well screen to remove sediment encrusted on the well casing and screen. Similar to bailing, the up and down movement of the brush produces a surging effect, initiating the redevelopment process. As the well casing is brushed, any biofilm, along with any scale and encrustation, will be allowed to settle to the bottom of the well.

Following brushing, the well should be redeveloped using a small diameter pump to remove the material that has settled into the well. During pumping, the well may be moved up and down over a small portion of the screened interval to create an additional surge effect. The pumping should continue until no further silt or other loosened material is observed. Any waste derived from mechanical redevelopment will be properly managed through final disposition. A video inspection is recommended following redevelopment to determine if the process was successful in removing encrustation from the screen.

3.3 CHEMICAL TREATMENT

If analytical results or well performance indicate no improvement after the use of mechanical techniques, chemical redevelopment techniques may be employed. Chemicals that have been used for well rehabilitation include acids, biocides, oxidizers, and other additives. The specific chemical, or chemical mixture, used depends on the type of well problem to be addressed. Typical acids are recommended for rehabilitation (e.g., acetic acid, glycolic acid, and other organic acids such as oxalic and citric acid) (Alford et al. 2000). The Kentucky Division of Waste Management has expressed concern with using sulfamic acid in landfill compliance wells due to the potential to create sulfates. Regulatory approval must be obtained prior to implementing chemical treatments in MWs.

Full rehabilitation using a chemical treatment method often is conducted only if severe biofouling and/or microbial plugging have occurred such that mechanical redevelopment alone is not sufficient. This method combines conventional mechanical treatments (brushing, jetting, surging, and pumping) with chemical application.

Care will be taken to follow all federal, state, and local regulations pertaining to the handling of treatment chemicals. Volumes of all chemicals injected will be recorded. It is anticipated that a majority of the chemicals will be recovered during the required subsequent redevelopment. During the removal phase, groundwater will be extracted until the water has low turbidity and the pH stabilizes to within 10% of the pre-treatment pH. Any waste derived from well rehabilitation will be properly managed through final disposition.

4. REFERENCES

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BJC 2000b. *C-746-K Landfill, C-404 Burial Ground, Northeast Plume Monitoring Wells, and Northwest Monitoring Wells, (North and South Fields) Camera Inspections at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, BJC/PAD-204, Bechtel Jacobs Company LLC, August.

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APPENDIX

PGDP MONITORING WELL INSPECTION CHECKLIST

PGDP MONITORING WELL INSPECTION CHECKLIST

WELL INFORMATION			
Well Number: ____________	Well Depth (ft below TOC): ____________		
ANNUAL INSPECTION ITEMS			
Inner Well Casing:	**YES**	**NO**	**N/A**
1. Is the inner or outer casing corroded, bent, dent, cracked, etc?			
2. Has the well casing sustained vehicular damage?			
3. If warranted, is a weep hole located at the base of the outer protective casing?			
4. Is the inner or outer casing loose (annular seal problem)?			
5. If flush-mounted, is the gasket seal in good condition?			
Well Security:			
6. Does the outermost casing have a lockable cap or lid?			
7. Is the lock present?			
8. Where applicable, are the hasps welded firmly to the cap and/or casing?			
9. If flush-mounted, is the cap lockable (and locked)?			
Well Identification:			
10. Is the well number or ID clearly legible?			
11. Is the well identification number correct?			
12. Is the AKGWA tag present?			
Down-Hole Condition:			
13. Is dedicated sampling equipment present in the well?			
14. Is a reference point clearly marked at the top of casing or top of well cap?			
Well Access:			
15. Does the access road require regarding or additional gravel?			
16. Does the access road or well area require weed-eating or mowing?			
Concrete Pad:			
17. Is a concrete pad installed?			
18. Is the concrete pad cracked or deteriorated?			
19. Does the pad slope away from the casing?			
Protective Posts:			
20. Are the protective posts damaged?			
21. Do the protective posts require painting for visibility?			
TRIENNIAL INSPECTION ITEMS			
Down-Hole Condition:			
22. What is the measured depth of the well from top of casing (reference mark)?	____________ ft		
23. Do any obstructions occur within the well?			
24. Is the bottom of the well soft (i.e. mud on the measurement line)?			
COMMENTS			
Inspection Date: ____________	Inspected by: ____________		

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Comment Response Summary

for the

Monitoring Well Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(PRS/PROJ/0025)

October 2007

Prepared for
U.S. Department of Energy
Office of Environmental Management

COMMENT RESPONSE SUMMARY for the *Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* *(PRS/PROJ/0025)*			
Comment Number	**§/Page/¶.**	**Reviewer and Comment**	**Response**
Comments from DOE Received October 1, 2007			
1	Executive Summary	In the 2002 plan there is discussion of the 75 wells needed maintenance. The same discussion is included here. Have these wells been cleaned since then, have any new ones been identified.	Since the maintenance program began in 2002, a total of 103 monitoring wells have been rehabilitated, including 53 of the 75 wells identified for rehabilitation in Section 1.3 of the 2002 plan. Attachment 1 lists all 103 rehabilitated wells; Attachment 2 shows which of 75 wells identified for rehabilitation in Section 1.3 of the 2002 plan have been rehabilitated and those that have not. For those that were not rehabilitated, a short explanation is included. The current plan has been revised to indicate the total number of wells that have been rehabilitated since inception of the maintenance program. Note: The wells targeted for 2003 rehabilitation that were not rehabilitated due to mechanical problems still are performing as designed. This sustained performance is one of the factors that lead to the 2007 plan revision and the replacement of the old schedule-driven routine with a new performance-based routine.
2	Executive Summary	There is no reference in the document on how or when the cameras will be used again. Is there any criteria that dictates when or where we will do these inspections?	Section 2.4 discusses that down-hole video is not part of "routine" maintenance monitoring, which is the same as in the original plan and the 2005 revision. Video inspection is planned to be used, if necessary, for further evaluation of severe down-hole problems that are detected as part of routine maintenance monitoring (inspection of down-hole equipment, changes in well performance, or physicochemical changes) or to evaluate rehabilitation effectiveness.

32

COMMENT RESPONSE SUMMARY
for the
Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(PRS/PROJ/0025)

Comment Number	§/Page/¶.	Reviewer and Comment	Response
3	General	The 2002 document has a waste management section only a minor reference to waste at the end of the document now.	PRS plans to generate project-specific waste management and transportation plans prior to well rehabilitation field implementation (in a similar manner that health and safety plans also will be developed depending on the activity and chemicals to be used). Waste generated as a result of field activities has the potential to contain contaminants, such as trichloroethene (TCE) and technetium-99 (^{99}Tc), as well as chemicals used in the rehabilitation process (which are tailored to the specific well problems).
4	General	Should we discuss the wells and piezometers that have been installed or removed since 2002?	Wells and/or piezometers that have been installed at the site and their current status (active, abandoned, etc.) are included as an appendix in the annually revised Environmental Monitoring Plan. The EMP is referenced in this plan (Section 1.1) as containing a list of all monitoring wells and/or piezometers at the site, along with their status.
5	Section 2.4, page 6	If there is a down-hole camera available at the site wouldn't we want to have video data as to the condition of a least the compliance wells on a routine basis.	There is no camera at the site suitable for this application. When a down-hole video survey is needed, the contractor will procure the down-hole video service.
6	Section 3.3, page 9	Why do we only state that regulatory approval must be obtained prior to implementing? Why are we talking to the state and determining what they will accept if anything. The use of acid was acceptable, so surely we can determine what additive and ways to implement them can be developed upfront, thereby not create a delay when work is needed to be performed.	A comment response summary for the Groundwater Assessment Plan for the C-746-U Landfill was received by KDWM on August 27, 2007. The CRS stated that KDWM approval would be sought for the specific chemical application prior to use. KDWM has advised the site to use acetic acid, which is one of the recommended acids for rehabilitation. Chemical treatment is planned only if mechanical treatment is insufficient for rehabilitation. No chemicals should be injected into a monitoring well without regulatory approval.

33

COMMENT RESPONSE SUMMARY
for the
Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(PRS/PROJ/0025)

Comment Number	§/Page/¶.	Reviewer and Comment	Response
7	General	A similar document was produced in 2002 for U.S. DOE. Material from that document was copied verbatim into the current plan, yet there is no mention of the 2002 Plan in the reference citations. Why?	This is a revision of the version of the plan issued in July 2005 (text was not copied verbatim but rather left in place). Both previous versions will be referenced.
8	Section 2.2, page 5	In a previous comment response, it was suggested that the science of Well Biofouling has evolved since 1995. The PRS response indicated that not much has changed with regard to physicochemical indicators and both Smith 1995 and ASTM 2005 were cited. Were other references consulted as well? It is a DOE expectation that the most current technological information be utilized. Please document all sources consulted.	A separate list of other documents and sources reviewed or consulted is attached to this Comment Response Summary (Attachment 3) for DOE's use. The reference list will not be changed to include all sources consulted. Only those documents or reports specifically referenced in the text will be listed in Section 4.

34

COMMENT RESPONSE SUMMARY
for the
Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(PRS/PROJ/0025)

Comment Number	§/Page/¶.	Reviewer and Comment	Response
9	General Comment	The approved 2002 document contained a base schedule that documented a plan for monitoring well rehabilitation of all wells at the site. The stated intent was to treat and rehabilitate all the monitoring wells (and piezometers) one time to create baseline information. A schedule for subsequent rehab of compliance wells, surveillance wells, and water level wells was to be developed from the baseline rehabilitation effort. There is no evidence that this baseline well rehab was completed. There is not much in the way of a formally stated schedule for the performance of monitoring well maintenance in the proposed revision. The sentence or two at the end of section 2.0 does not constitute a formal schedule.	The stated intent of the original 2002 plan and the 2005 revision was to initiate maintenance monitoring on all wells. Maintenance monitoring involves the collection of information (physicochemical parameters, visual observations, well performance) necessary to determine when maintenance is necessary. This information is to be used on an annual basis to determine if additional wells require maintenance or rehabilitation after all the compliance wells had been initially treated. Both the 2002 and 2005 versions of the plan state in Section 2.3.1, "consequently, on an annual basis maintenance monitoring data suggestive of biofouling (e.g., oxidation-reduction potential, pH, conductivity, Fe, Mn, and S concentrations) along with other factors such as the well's strategic location and visual sample examination and pump condition will be used to select wells requiring maintenance." Rehabilitation of all compliance wells was completed from FY 2002 through FY 2004. Using a graded approach, it is more cost-effective to perform maintenance and rehabilitate wells that require treatment based on the criteria discussed in Section 3 of the revised plan rather than establishing that a set number of wells be treated annually. Other than annual inspections (or triennial inspections for well/piezometers where only water levels are obtained) and annual reviews of the physicochemical data, well performance data, and other well inspection information, no formal schedule is proposed.
10	General Comment	There is no description of a transportation plan covering the transport of any waste generated from any well rehab activities. Does PRS have a stand alone Transportation Plan that covers this activity and if yes, why is it not referenced in this document?	See response to Comment #3.

36

COMMENT RESPONSE SUMMARY for the *Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* *(PRS/PROJ/0025)*			
Comment Number	**§/Page/¶.**	**Reviewer and Comment**	**Response**
11	General Comment	The intent for updating of the Monitoring Well Maintenance Implementation Plan appears to be aimed at addressing KY Div. of Waste Management concerns expressed in a May 18, 2007 letter RE: Technical Notice of Deficiency of #1 Groundwater Assessment Plan, C-746-U Solid Waste Landfill, Specifically items 2 and 3. In comment 2, KDWM claims "Sulfamic Acid (part of the BCHT process) use in well rehab is not approved" and directs DOE to "discontinue the practice until further review has been conducted and Division approval has been obtained." In comment 3, the Division expresses concerns regarding the use of sulfamic acid is appropriate at this site (U Landfill) citing possible ammonia breakdown products resulting from heating and possible sulfate byproduct formation. The proposed plan fails to address how PRS will work with the Division on the behalf of DOE to resolve this issue and develop alternatives. Reiterates and expands on Comment 6 above.	The plan required revision due to a change in the approach since the July 2005 revision prepared under Bechtel Jacobs LLC. It was decided using a graded approach and evaluating data from the wells to determine if rehabilitation was appropriate was the best approach, rather than simply stating the site would rehabilitate a certain number of wells regardless of their performance. This revision was initiated in April 2007, approximately one month prior to the site receiving the referenced letter from KDWM. This plan will be revised to list acids that are recommended for monitoring well rehabilitation, for instances, where chemical treatment will be considered, but will not include how the issue at the C-746-U Landfill is to be resolved. The specific chemical, or mixture or chemicals, to be used will depend on the specific well problem (biofouling, mineral encrustation, or sediment blockage) to be addressed.
12	General Comment	There is no discussion of how PRS will address "problem wells" that contain pumps that cannot be removed due to down-hole problems in the wells. Proposed inspections and rehabilitations cannot be performed in these wells. Please discuss how these wells will be addressed.	PRS will follow the decision tree provided in Figure 1 of the revised plan. If a "problem well" is damaged beyond practical repair, it should be abandoned and a replacement well installed, if necessary.